

## Respiration



***"The process of releasing energy from food is called respiration".***

## 2.1 Introduction

Most living beings need oxygen (of air) to obtain energy from food. This oxygen reacts with the food molecules (like glucose) present in the body cell and burns them slowly to release energy. The energy thus released is stored in ATP molecules in the cells. The body can use this stored energy whenever it wants to do so.

## 2.2 Respiration

Respiration is the process by which the food taken through nutrition gets oxidised to release energy for various activities.

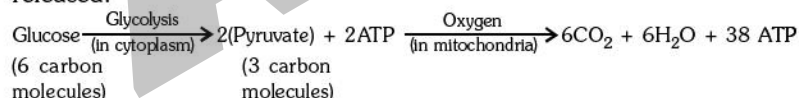
### 2.3 Types of respiration

Process of respiration can be divided into the following two categories :

- (1) Aerobic respiration                      (2) Anaerobic respiration

(1) **Aerobic respiration**

It is a process in which there is complete break down of food (glucose) into carbon dioxide and water in the presence of oxygen and energy is released.

**ACTIVE BIOLOGY 2.1**

### Aim

To demonstrate that germinating seeds produce  $\text{CO}_2$  in aerobic respiration.

## Method

Put some germinating seeds in a conical flask. With the help of a thread suspend a small tube containing KOH in the flask. Through the hole of the cork pass a glass tube bent twice at right angles. One end of the tube is in the flask while the other end is in the beaker filled with water. Make the apparatus air tight. Note the level of water in the tube. Keep the apparatus for sometime and again note the level of water.

### Observation

It is observed that water rises in the tube. The rise in the level of water is due to a partial vacuum created in the flask because the gas produced during respiration i.e.  $\text{CO}_2$  is absorbed by  $\text{KOH}$ .

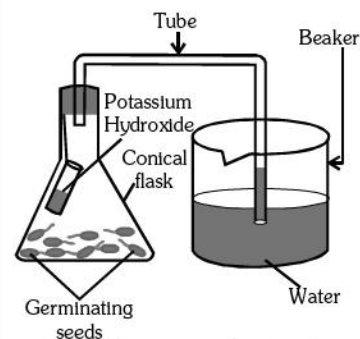
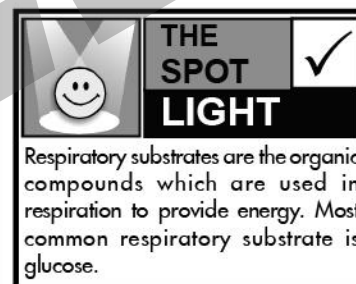
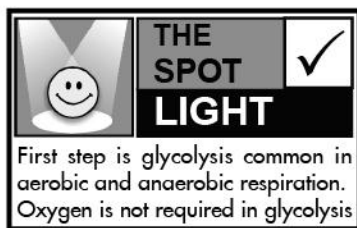


Fig.1 Experimental setup for Aerobic Respiration



### Conclusion

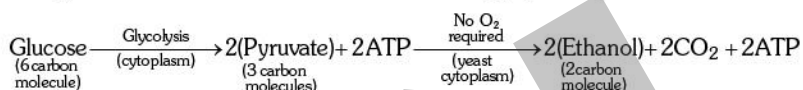
As KOH has the property to absorb  $\text{CO}_2$  hence, this shows that germinating seeds produce  $\text{CO}_2$  during aerobic respiration.

### (2) Anaerobic respiration

It is partial breakdown of food (glucose) without using molecular oxygen, the respiration is called anaerobic respiration. In this type of respiration much less amount of energy is produced. It also includes glycolysis which takes place in the cytoplasm. During this process one molecule of glucose is degraded into two molecules of pyruvic acid (pyruvate) and little energy (2 ATP) is produced. The pyruvic acid is further broken down into two different manners :

- (i) Fermentation (ii) Anaerobic respiration in muscle cells

**(i) Fermentation [Alcoholic Fermentation]** : It is a kind of anaerobic respiration in which the microorganisms (yeast) break down glucose into ethyl alcohol and carbon dioxide and energy (2 ATP) is released.



### BUILDING CONCEPTS 2.1

Can cell survive in the absence of oxygen?

#### Explanation

Yes, some cells can survive in the absence of oxygen. For example yeast and most of bacteria can survive in anaerobic conditions. Thus all the cells do not use oxygen to produce energy.

### ACTIVE BIOLOGY 2.2

#### Aim

To demonstrate that yeast produce  $\text{CO}_2$  by fermentation of sugar.

#### Method

Take some fruit juice or sugar solution in conical flask and add some yeast into it. Put a few drops of oil to cut contact of external air. Close the opening of test tube with a one holed cork. Insert a bent glass tube in the cork and dip the other end of tube into the beaker containing lime water (solution of calcium hydroxide). Observe after few hours.

#### Observation and conclusion

The lime water turns milky. This shows that  $\text{CO}_2$  is liberated from the mixture of sugar solution and yeast. Fermentation of sugar results in the production of ethyl alcohol and  $\text{CO}_2$ .

#### (ii) Anaerobic respiration in muscle cells [Lactic acid fermentation]:

Human muscle cells make ATP by lactic acid fermentation, when oxygen is scarce. This occurs at the time of vigorous exercise, when demand of oxygen by the muscles is greater than its supply. Therefore, the muscles switch from aerobic respiration to fermentation resulting in the production of lactic acid. This lactic acid accumulates in the muscles causing cramps or muscle fatigue.

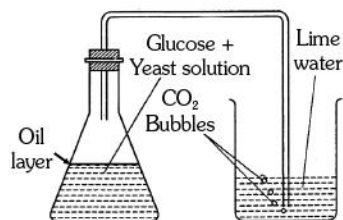


Fig.2 To demonstrate the process of fermentation.

### Differences between Aerobic and Anaerobic respiration

S.NO	Features	Aerobic Respiration	Anaerobic Respiration
1	O <sub>2</sub> requirement	O <sub>2</sub> required	Not required
2	Occurs in	Cytoplasm and mitochondria	Cytoplasm only
3	Breakdown	Complete breakdown of glucose takes place	Incomplete breakdown of glucose takes place
4	End products	CO <sub>2</sub> and H <sub>2</sub> O	CO <sub>2</sub> and ethyl alcohol or lactic acid
5	Energy produced from one glucose molecule	38 ATP	2 ATP

### CHECK YOUR CONCEPTS 2.1

1. Name an organism which can live without oxygen.
2. Name two substances which are produced in anaerobic respiration but not in aerobic respiration.
3. During respiration in organism A, 1 molecule of glucose produces 2 ATP molecules whereas in another organism B, 1 molecule of glucose produces 38 ATP molecules. Identify A and B.

### 2.4 Gaseous exchange in Plants

The plants do not have any special respiratory system so they have to respire in all of their individual parts like leaf, stem and root.

The plants also have to exchange gases with the atmosphere by simple diffusion process. Direction of diffusion depends upon the environmental condition and the requirement of the plant.

Aquatic plants can carry out gaseous exchange by diffusion over their whole surfaces.

#### Gaseous exchange through stomata

Oxygen enters into the plant body through stomata by the process of diffusion and then goes into other cells of the leaf. The intercellular spaces which are present throughout the plant ensure that all the cells are in contact with air. These intercellular spaces reduce the distance of diffusion between cells and air.

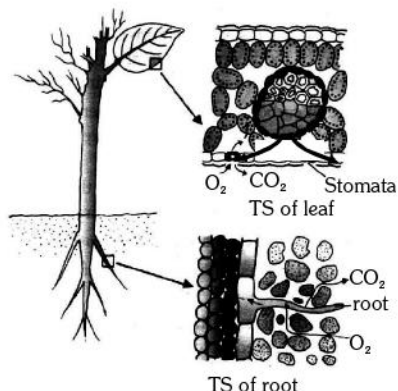


Fig.3 Exchange of gases through stomata and root

**THE SPOT LIGHT**

ATP is Adenosine triphosphate which function as energy currency in various cellular activities. Phosphorylation is the addition of a phosphate group to a molecule for example synthesis of ATP from ADP and inorganic phosphate.

**THE SPOT LIGHT**

Single molecule of ATP is broken down giving rise to 30.5 kJ/mole or 7.3 kcal/mole energy which can drive the endothermic reactions taking place in the cell. ATP can be used for the contraction of muscles, protein synthesis, conduction of nerve impulse and many other activities.

**THE SPOT LIGHT**

In terrestrial plants gaseous exchange occurs through

- (a) Stomata - In leaves and green stem.
- (b) Lenticels - In woody stem and roots
- (c) Root hairs - In young roots

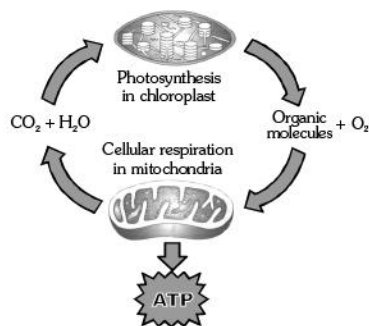


Fig.4 Cyclic representation of relation between photosynthesis and respiration

**THE  
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LIGHT**

The rate of breathing in aquatic organisms is much faster than terrestrial organisms, because water has low content of oxygen than air.

**THE  
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LIGHT**

The terrestrial animals have to adapt to the problems such as protection to the respiratory surface from dryness and maintaining the respiratory surface always moist as they lose plenty of water by evaporation.

During the day,  $\text{CO}_2$  generated during respiration is used up for photosynthesis hence there is no  $\text{CO}_2$  release instead oxygen release in the atmosphere is the major event. Rate of photosynthesis is high as compared to respiration during day time.

During the night, stomata is closed and photosynthesis does not occur.  $\text{CO}_2$  elimination is the major exchange activity going on because  $\text{CO}_2$  liberated during respiration is not used in photosynthesis.

### BUILDING CONCEPTS 2.2

Why a land plant may die if the soil is water logged?

#### Explanation

Plant often die in water logged soil because the soil is unable to supply sufficient oxygen to roots. Under these conditions root will respire anaerobically, producing alcohol.

## 2.5 Gaseous exchange in aquatic animals

Fish takes dissolved oxygen from water. Fish has special organs of breathing called gills.

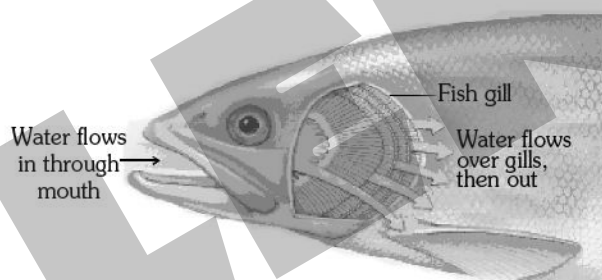


Fig.5 Gaseous exchange in fish

Fish breathes by taking in water through its mouth and sending it over the gills. When water passes over the gills, the gills extract dissolved oxygen from this water. The extracted oxygen is absorbed by the blood and carried to all the parts of the fish and carbon dioxide produced by respiration is brought back by the blood into the gills for expelling into the surrounding water.

### CHECK YOUR ANSWERS 2.1

1. Yeast and most of bacteria.
2. Ethyl Alcohol ( $\text{C}_2\text{H}_5\text{OH}$ ) and lactic acid
3. (A) Yeast ; (B) Human

### BUILDING CONCEPTS 2.3

Why do fishes die when taken out of water?

#### Explanation

Fishes have gills as respiratory structures which can take in only dissolved oxygen from water. So, outside water, they can not respire and therefore die.

## 2.6 Gaseous exchange in terrestrial animals

Different land animals have different organs for gaseous exchange like skin or general body surface, as in earthworm, air tubes or trachea, as in insects (grasshopper, cockroach, housefly) and lungs as in frog, lizard, birds, rat and humans.

**BUILDING CONCEPTS 2.4**

What are the adaptations for gaseous exchange in terrestrial organisms?

**Explanation**

Terrestrial animals possess some adaptation in their respiratory structures to promote better exchange of gases. These adaptations are

- (i) Large surface area to get enough oxygen. (ii) Thin permeable membrane for easy diffusion of gases. (iii) Abundant blood supply for transporting respiratory gases.

**2.7 Gaseous exchange in human beings**

**Respiratory system**

A pair of external nostrils open into a pair of nasal passages. The nasal passages are highly vascularised, have fine hairs and mucus secreting cells, so that the inspired air gets warmed, moistened and becomes dust free (filter). The dust particles are entrapped in the mucus secreted by mucus cells.

The nasal chambers open into pharynx. The pharynx provides passage into trachea or wind pipe via larynx.

The wall of trachea has incomplete cartilagenous rings (C-shaped), which prevent the trachea from collapsing even if there is not much air in it. Trachea runs down the neck and extends into thoracic cavity.

Trachea divides into bronchi (singular : bronchus). Each bronchus divides and redivides to form finer branches called bronchioles. After repeated divisions each bronchiole ends into a cluster of tiny air chambers called air sacs or alveoli.

**Route of inhaled air**

External nostrils → Nasal cavity → Pharynx → Larynx → Trachea → Bronchi → Bronchioles → Alveoli.

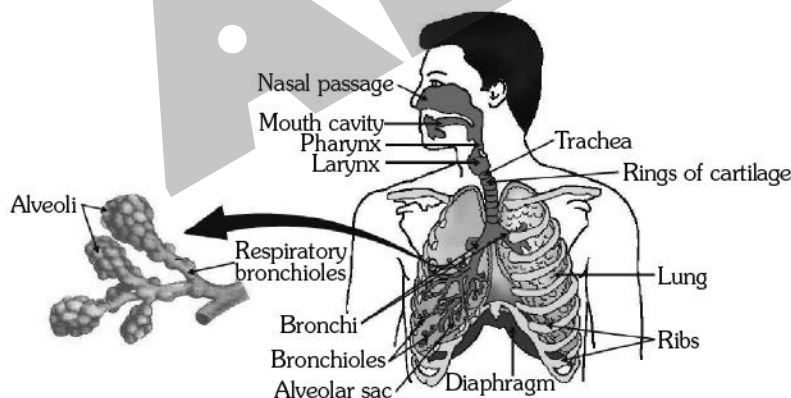


Fig.6 Human respiratory system

**Lungs**

The lungs are a pair of spongy, bag-like organs, which is enclosed by a double layered membrane or covering called pleura.

Alveoli are structural and functional units of lungs as these are the actual site of gaseous exchange.

**THE SPOT LIGHT**

The nasal cavities are separated from the oral cavity by a bony palate. It is due to this reason we can breathe while we eat. Epiglottis prevents the entry of food into respiratory tract.

**THE SPOT LIGHT**

In our body the voice box called larynx is present. Two vocal cords are present inside the larynx. Vibration in the vocal cords results in production of sound by expired air.

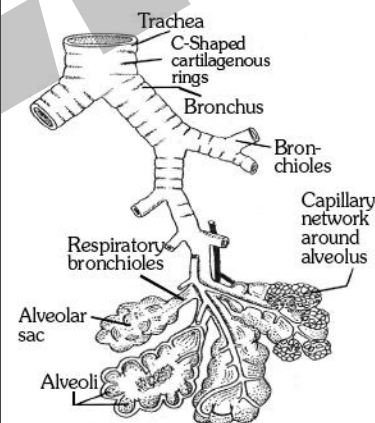


Fig.7 Alveoli and network of capillaries

**THE SPOT LIGHT**

There are very large number of alveoli present in lungs which have a total surface area of about 80 m<sup>2</sup>. Alveoli are covered with a network of capillaries.

**THE  
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LIGHT**

Haemoglobin is the respiratory pigment which is present in the red blood corpuscles (RBC). Haemoglobin has a very high affinity to oxygen.

**THE  
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LIGHT**

Space between two ribs is called intercostal space in which 2 types of muscles are present that are known as external and internal intercostal muscles.

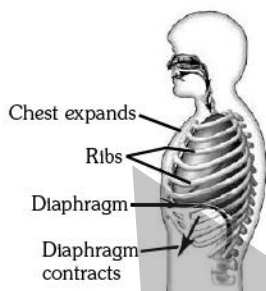


Fig.8 Inhalation

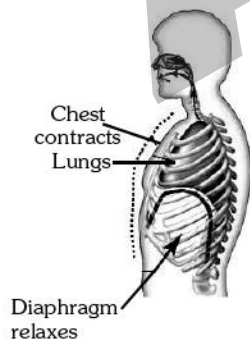


Fig.9 Exhalation

### Exchange of gases in alveoli

Exchange of gases takes place in the alveoli. Inhaled air in the alveoli has high oxygen concentration than that in the blood. Hence, the oxygen diffuses from the alveoli into the blood. It passes first into the blood plasma and then combines with the haemoglobin in the red blood corpuscles to form oxyhaemoglobin. Carbon dioxide in the blood capillaries is in higher concentration than that in the alveoli. Therefore carbon dioxide diffuses from the blood into the alveoli.  $\text{CO}_2$  is more soluble in water than oxygen hence  $\text{CO}_2$  is mostly transported in the dissolved form in our blood.

### BUILDING CONCEPTS 2.5

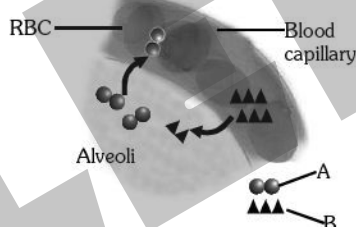
Why there is a need of respiratory pigment in multicellular organisms?

#### Explanation

In multicellular organism, the diffusion pressure alone can not take care of oxygen delivery to all parts of body, instead respiratory pigment present in blood take up oxygen from the air in the lungs and carry it to tissues which are deficient in oxygen.

### CHECK YOUR CONCEPTS 2.2

1. Identify the gaseous molecule A and B in below diagram.



2. What can happen when cartilagenous rings are absent on wall of trachea?
3. Why is  $\text{CO}_2$  mostly transported in the dissolved form in our blood?

### Breathing

The stage of respiration during which air is inhaled into the lungs through the mouth or nose due to muscle contraction and then exhaled due to muscle relaxation is called breathing.

#### Mechanism of Breathing

Lungs cannot expand or contract on their own. The contraction and expansion of lungs is brought about by diaphragm muscles and external intercostal muscles.

#### (1) Inhalation (Inspiration)

Inhalation is intake of fresh air from outside into the alveoli of the lungs. It occurs by expansion of lungs which is brought about by enlargement of thoracic cavity. Inhalation involves the following steps:-

The diaphragm (a dome shaped, muscular structure that separates thoracic cavity from abdominal chamber) contracts so that the diaphragm lowers down and becomes flat.

External intercostal muscles contract so that the ribs and sternum are pulled upward and outward. This causes enlargement of thoracic cavity resulting in the expansion of lungs.



Expansion of lungs reduces the pressure of air inside so that the fresh air is pulled from outside into the lungs passing through nostrils, trachea and bronchi. Fresh air has a rich supply of  $O_2$  which goes into the blood passing through thin membranes of alveoli and blood capillaries. As a result the blood in the capillaries becomes loaded with oxygen and expels carbon dioxide into the alveoli for exhalation.

## (2) Exhalation [Expiration]

The mechanism of breathing out of carbon dioxide is called exhalation. During exhalation, muscle of the diaphragm relaxes so that the diaphragm becomes dome shape.

The external intercostal muscles also relax by which ribs and sternum comes downward and inward, by which the volume of thoracic cavity is reduced and lungs also contract.

Contraction of lungs increases the air pressure so that the foul air moves out.

### BUILDING CONCEPTS 2.6

How is smoking injurious to health?

#### Explanation

The upper part of respiratory tract is provided with small hair-like structures called cilia. These cilia help to remove germs, dust and other harmful particles from inhaled air. Smoking destroys these hair due to which germs, dust, smoke and other harmful chemicals enter lungs and cause infection, cough and even lung cancer. Lung cancer is one of common causes of deaths in the world.

### CHECK YOUR ANSWERS 2.2

1. A is oxygen and B is carbon dioxide.
2. Trachea or wind pipe will collapse and air (oxygen) will not reach into alveoli. Exchange of gases will be stopped.
3. Because  $CO_2$  is more soluble in water than oxygen hence  $CO_2$  is mostly transported in the dissolved form in our blood.

**THE  
SPOT  
LIGHT**

Residual volume (RV) is the amount of air remaining in the lungs at the end of a maximum expiration.

Rate of breathing :

In children – 18-22/min  
In adolescents – 14-18/min  
In adult – 12-14/min

**THE  
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Using tobacco directly or any product of tobacco in the form of cigar, cigarettes, bidis, hookah, gutkha, etc., is harmful. Use of tobacco most commonly affects the tongue, lungs, heart and liver. Smokeless tobacco is also a major risk factor for heart attacks, strokes, pulmonary diseases and several forms of cancers. There is a high incidence of oral cancer in India due to the chewing of tobacco in the form of gutkha.

## Important Notes

ALLEN



# NCERT QUESTIONS WITH SOLUTIONS

1. Why is diffusion insufficient to meet the oxygen requirements of multicellular organisms like humans?

**Ans.** Every living cell requires oxygen for performing cellular respiration. In unicellular organisms (e.g., *Amoeba*), the single cell is in direct contact with environment. Oxygen passes into it through diffusion. In simple multicellular organisms (e.g. *Hydra*), every cell may also take oxygen through diffusion from environment. This is not possible in complex multicellular organisms like humans. The body is covered by dead cells. The living cells are not in contact with external environment. Air containing intercellular spaces are absent. Therefore, quick diffusion cannot occur. Cell to cell diffusion is a very slow process. Passage of oxygen from lungs to toes through cell to cell diffusion will take about three years. Therefore, diffusion cannot meet the oxygen requirement of multicellular organisms like humans.

2. What advantage over an aquatic organism does a terrestrial organism have with regard to obtaining oxygen for respiration?

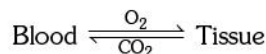
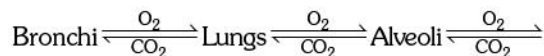
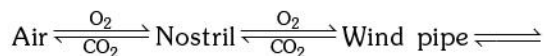
**Ans.** Air contains about 21% of oxygen while water has less than 1% oxygen in dissolved state. A terrestrial organism is able to get several times more oxygen than an aquatic organism in one breath.

3. How is oxygen and carbon dioxide transported in human beings?

**Ans.** During inhalation, oxygen comes into alveoli of the lungs. The alveoli is surrounded by very thin blood vessels called capillaries. So, the oxygen is carried by blood to all the parts of body by binding it with haemoglobin present in blood.

The blood passes through the tissues of the body and oxygen present in it diffuse into the cells (due to its higher concentration in the blood). This oxygen combines with the digested food present in the cells to release energy. Carbon dioxide is produced as a waste product during respiration in the cells of the body tissues. This  $\text{CO}_2$  diffuses into the blood (due to its higher concentration in body tissues). Blood carries  $\text{CO}_2$  back to the lungs where it diffuses into the alveoli of the lungs and pass into the trachea, nostrils and then out of the body into air.  $\text{CO}_2$  is more soluble in water than oxygen and hence mostly

transported in the dissolved form in our blood.



4. How are the lungs designed in human beings to maximize the area for exchange of gases?

**Ans.** Lungs are two soft spongy structures lodged in the thoracic cavity. Each lung is enclosed in a double-walled sac called pleura. In the lungs, the air passage (wind pipe) divides into smaller tubes, called bronchi which in turn form bronchioles. The bronchioles later terminates in balloon-like structures, called alveoli. The presence of alveoli in the lungs provides a very large area for the exchange of gases and this availability of large surface area maximises the exchange of gases. The alveoli have very thin walls and contain an extensive network of blood vessels to facilitate exchange of gases.

5. How are alveoli designed to maximise the exchange of gases?

**Ans.** Alveoli are small pouches or sacs. Large number of alveoli occur inside each lung. The whole surface of an alveolus functions as respiratory surface. Due to large number of alveoli in each lung, a very large area of respiratory surface becomes available (about  $80 \text{ m}^2$ ) for exchange of gases. The walls of alveoli are very thin and they are surrounded by blood capillaries.

6. How is respiration different from breathing?

**Ans.**

Breathing	Respiration
It is a physical process. It involves inhalation of fresh air and exhalation of foul air.	It is a biochemical process. It involves exchange of respiratory gases and also oxidation of food.
It does not involve enzyme action.	It involves a number of enzymes required for oxidation of food.
It does not release energy.	It releases energy.
It is confined to certain organs only	It occurs in all the cells of the body.

7. What are the differences between respiration and photosynthesis?

**Ans.**

Photosynthesis	Respiration
It takes place in green cells of plants.	It takes place in all living beings.
It occurs during day time only	It occurs throughout the life of an organism.
Energy is stored	Energy is released
CO <sub>2</sub> and H <sub>2</sub> O both are used up	CO <sub>2</sub> and water are released
Food and oxygen are produced	Food and oxygen are used up
It is an anabolic process	It is a Catabolic process

8. What are the differences between aerobic and anaerobic respiration? Name some organisms that use the anaerobic mode of respiration.

**Ans.**

Aerobic Respiration	Anaerobic Respiration
O <sub>2</sub> is required	Not required
It occurs in Cytoplasm and mitochondria	It occurs in Cytoplasm only
Complete breakdown of glucose takes place	Incomplete breakdown of glucose takes place
End products are CO <sub>2</sub> and H <sub>2</sub> O	End products are CO <sub>2</sub> and ethyl alcohol or lactic acid
38 ATP produced from one glucose molecule	2 ATP produced from one glucose molecule

Yeast & most of bacteria

# EXERCISE # 1

## Multiple choice questions

- Respiration is the process in which
  - energy is stored in the form of ADP
  - energy is released and stored in the form of ATP
  - energy is not released at all
  - energy is used up
- Respiration and photosynthesis are just the
  - Opposite processes
  - Similar processes
  - Burning processes
  - None of these
- When air is blown from mouth into a test-tube containing lime water, the lime water turns milky due to the presence of
  - Oxygen
  - Carbon dioxide
  - Nitrogen
  - Water vapour
- Which of the following is the primary substrate in respiration
  - Vitamins
  - Fats
  - Glucose
  - Proteins
- The form of energy used in respiration is
  - Chemical energy
  - Electrical energy
  - Mechanical energy
  - Radiant energy
- Which of the following is most appropriate for aerobic respiration?
  - Glucose  $\xrightarrow{\text{mitochondria}}$  Pyruvate  $\xrightarrow{\text{cytoplasm}}$   $\text{CO}_2 + \text{H}_2\text{O} + \text{Energy}$
  - Glucose  $\xrightarrow{\text{cytoplasm}}$  Pyruvate  $\xrightarrow{\text{mitochondria}}$   $\text{CO}_2 + \text{H}_2\text{O} + \text{Energy}$
  - Glucose  $\xrightarrow{\text{cytoplasm}}$  Pyruvate + Energy  $\xrightarrow{\text{mitochondria}}$   $\text{CO}_2 + \text{H}_2\text{O}$
  - Glucose  $\xrightarrow{\text{cytoplasm}}$  Pyruvate + Energy  $\xrightarrow{\text{mitochondria}}$   $\text{CO}_2 + \text{H}_2\text{O} + \text{Energy}$
- Glycolysis occurs in
  - Cytoplasm
  - Mitochondria
  - Chloroplast
  - Golgi complex
- Anaerobic breakdown of glucose in our muscles produces
  - Pyruvate
  - Lactic acid
  - Ethyl alcohol
  - Oxalic acid

- Which of the following processes is responsible for cramps in the muscles of sportsmen?
  - Nonconversion of glucose to pyruvate
  - Conversion of pyruvate to lactic acid due to deficiency of oxygen
  - Conversion of pyruvate to glucose in presence of oxygen
  - Conversion of pyruvate to ethanol
- The narrowest and most numerous tubes of lungs are termed as
  - Bronchus
  - Bronchioles
  - Alveolar sac
  - None of these
- The correct sequence of anaerobic respiration in yeast is
  - Glucose  $\xrightarrow{\text{cytoplasm}}$  Pyruvate  $\xrightarrow{\text{mitochondria}}$  Ethanol + Carbon dioxide
  - Glucose  $\xrightarrow{\text{cytoplasm}}$  Pyruvate  $\xrightarrow{\text{cytoplasm}}$  Lactic acid
  - Glucose  $\xrightarrow{\text{cytoplasm}}$  Pyruvate + energy  $\xrightarrow{\text{mitochondria}}$  Lactic acid
  - Glucose  $\xrightarrow{\text{cytoplasm}}$  Pyruvate + energy  $\xrightarrow{\text{cytoplasm}}$  Ethanol + Carbon dioxide
- Which of the following statement (s) is (are) correct?
  - Pyruvate can be converted into ethanol and carbon dioxide by Yeast
  - Fermentation takes place in aerobic bacteria
  - Fermentation takes place in mitochondria
  - Fermentation is a form of anaerobic respiration
  - (a) and (c)
  - (b) and (d)
  - (a) and (d)
  - (b) and (c)
- In anaerobic respiration
  - $\text{O}_2$  is given out
  - $\text{CO}_2$  is given out
  - $\text{CO}_2$  is taken in
  - $\text{O}_2$  is taken in
- Exchange of gases in plants occurs through
  - Stomata
  - Lenticels
  - Root surface
  - All the above

15. In which part of the plant, rate of respiration is higher?  
 (1) Root and stem tip  
 (2) Buds  
 (3) Germinating seeds  
 (4) All of these
16. Plant cell can do  
 (1) Breathing and Respiration  
 (2) Respiration and photosynthesis  
 (3) Breathing and photosynthesis  
 (4) All of these
17. Plant can respire in  
 (1) Dark  
 (2) Light  
 (3) Both in light and dark  
 (4) Morning
18. Respiratory structures in the insects are  
 (1) Gills (2) Skin  
 (3) Lungs (4) Trachea
19. A normal man respire in a minute  
 (1) 10-15 times (2) 12-14 times  
 (3) 20-25 times (4) 25-30 times
20. Exchange of gases in earthworm takes place through  
 (1) Lungs (2) Skin  
 (3) Tracheal tubes (4) Gills
21. The structure which prevent the entry of food into respiratory tract is  
 (1) Pharynx (2) Larynx  
 (3) Glottis (4) Epiglottis
22. The structure which separates nasal cavity from oral cavity is  
 (1) Epiglottis (2) Diaphragm  
 (3) Palate (4) Pharynx
23. Oxygen in lungs ultimately reaches  
 (1) Alveoli (2) Trachea  
 (3) Bronchus (4) Bronchioles
24. The exchange of gases [ $O_2$  and  $CO_2$ ] in a mammal takes place in  
 (1) Trachea (2) Bronchi  
 (3) Bronchioles (4) Alveoli
25. Covering of lungs is  
 (1) Pleura (2) Pericardium  
 (3) Epiglottis (4) Capsule
26. During inspiration, muscles of diaphragm  
 (1) Contracts (2) Expands  
 (3) No effect (4) Coiled like string
27. Which of the following statement(s) is (are) true about respiration?  
 (a) During inhalation, ribs move inwards diaphragm is raised  
 (b) In the alveoli, exchange of gases takes place i.e. oxygen from alveolar air diffuses into blood and carbon dioxide from blood into alveolar air  
 (c) Haemoglobin has greater affinity for carbon dioxide than oxygen  
 (d) Alveoli increase surface area for exchange of gases  
 (1) (a) and (d) (2) (b) and (c)  
 (3) (a) and (c) (4) (b) and (d)
28. Which is the correct sequence of air passage during inhalation?  
 (1) Nostrils → larynx → pharynx → trachea → lungs  
 (2) Nasal passage → trachea → pharynx → larynx → alveoli  
 (3) Larynx → nostrils → pharynx → lungs  
 (4) Nostrils → pharynx → larynx → trachea → alveoli
29. Expiration involves  
 (1) Relaxation of diaphragm and intercostal muscles  
 (2) Contraction of diaphragm and intercostal muscles  
 (3) Contraction of diaphragm muscles only  
 (4) Contraction of intercostal muscles only
30. Haemoglobin, the respiratory pigment is found in  
 (1) WBC (2) RBC  
 (3) Platelets (4) Plasma

**True or false**

- All cells use oxygen to produce energy.
- Lactic acid is produced in anaerobic respiration.
- In muscles, anaerobic respiration produces  $\text{CO}_2$  water and energy.
- Fishes respire with the lungs.
- Lungs become empty after expiration.
- Maximum contraction of diaphragm causes maximum expiration.
- Expiration is normally brought about by the relaxation of diaphragm.
- Glycolysis takes place in the cytoplasm of the cell.
- Walls of trachea has incomplete rings of cartilage.
- All alveoli are not covered by web of blood capillaries.

**Fill in the blanks**

- Diffusion is insufficient to meet ..... requirement of multicellular organisms.
- Gaseous exchange in woody plants take place through ..... and .....
- ..... are the opening in the bark of woody stem.
- During the day time ..... gas release from the plant is the major event.

- ..... is the respiratory pigment which carry oxygen in blood.
- The ..... check the entry of food into the respiratory tract.
- Ring of ..... present in trachea and bronchi prevent their collapse when air is not passing through them.
- Lungs lie in the thoracic cavity separated by ..... from the abdominal cavity.
- The mechanism of breathing out of ..... is called exhalation.
- The structural and functional unit of mammalian lungs are.....

**Match the column**

- Match the items of Column I with items of Column II.

Column-I	Column-II
(A) Stomata	(i) Pleura
(B) Lungs	(ii) Gills
(C) Prawns	(iii) In herbaceous stem
(D) Housefly	(iv) Trachea

- Match the items of Column I with items of Column II regarding inhalation and exhalation.

Column-I	Column-II
(A) Diaphragm	(i) Increase
(B) Air pressure	(ii) Relax
(C) Intercostal muscles	(iii) Contract
(D) Thoracic cavity	(iv) Decrease

**EXERCISE # 1**

**ANSWER KEY**

**Multiple choice questions**

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	2	1	2	3	1	4	1	2	2	2	4	3	2	4	4	2	3	4	2	2
Que.	21	22	23	24	25	26	27	28	29	30										
Ans.	4	3	1	4	1	1	4	4	1	2										

**True or false**

1. False 2. True 3. False 4. False 5. False 6. False 7. True 8. True 9. True 10. False

**Fill in the blanks**

1. oxygen 2. stomata & lenticels 3. Lenticels 4. oxygen 5. Haemoglobin  
6. epiglottis 7. cartilage 8. diaphragm 9.  $\text{CO}_2$  10. Alveoli

**Match the column**

1. (A) – (iii), (B) – (i), (C) – (ii), (D) – (iv),  
2. In Inhalation : (A) – (iii), (B) – (iv), (C) – (iii), (D) – (i),  
In Exhalation : (A) – (ii), (B) – (i), (C) – (ii), (D) – (iv),

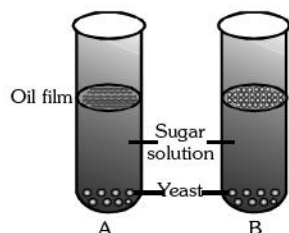
## EXERCISE # 2

## Very short answer type questions

1. Why is ATP called energy currency of cells?
2. Name the two processes which occur during aerobic respiration.
3. Where does glycolysis occurs inside cells?
4. Why yeast are commercially used in brewery (beer) industry?
5. What are the end products of aerobic respiration & anaerobic respiration?
6. Which part of root is involved in the exchange of respiratory gases?
7. Name the respiratory organs of  
(i) fish, (ii) earthworm, (iii) dog.
8. What is the role of larynx?
9. Why do the walls of trachea not collapse when there is less air in it?
10. What is the shape of cartilagenous rings in trachea?
11. Name the membrane covering the lungs.
12. Define breathing.
13. What happens to the thoracic cavity when diaphragm muscles contract?
14. What is the shape of diaphragm during expiration?
15. Name the respiratory pigment in human body.

## Short answer type questions

1. 'Respiration is a vital function of the body'. Justify.
2. In the test tubes A and B shown below, Yeast was kept in sugar solution. Which products of respiration would you expect in tubes A and B?



3. When we blow exhaled air into the solution of lime water, it turns milky. What actually happens in the solution?
4. What is the role of highly vascularised nasal cavity?
5. Define phosphorylation. How much energy is

produced from one molecule of ATP?

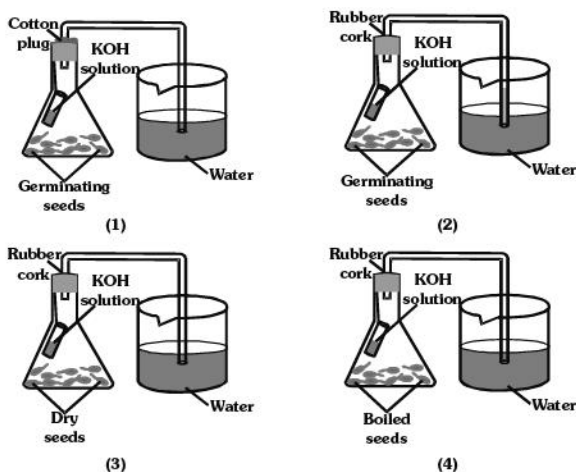
6. Explain the process of gaseous exchange in plants.
7. State the role of the following in the human respiratory system.  
(i) Diaphragm  
(ii) Alveoli.
8. Give reasons for the following :  
(i) The lung alveoli are covered with blood capillaries.  
(ii) The wall of trachea is supported by cartilage rings.
9. What happens to rate of breathing during vigorous exercise and why?
10. Write short note on exchange of gases in human beings

## Long answer type questions

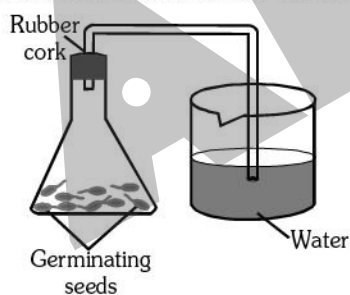
1. (i) Describe aerobic respiration.  
(ii) Describe the proces of anaerobic respiration.
2. Draw a diagram showing 'human respiratory system'. Label its following parts  
(i) Larynx (ii) Trachea  
(iii) Bronchus (iv) Lungs.
3. Differentiate between aerobic respiration and anaerobic respiration. After vigorous exercise, athletes and players generally experience cramps in their leg muscles. Why?
4. Describe the mechanism of breathing in human beings. What is the rate of breathing per minute?
5. (i) Explain how photosynthesis and respiration are two opposite processes with the help of a cyclic diagram.  
(ii) State the function of epiglottis.  
(iii) What is the role of intercostal muscles in respiration and where are these found?

### Activity based questions

1. Out of the four experimental set ups shown, which one will demonstrate the evolution of carbon dioxide during respiration of seeds?

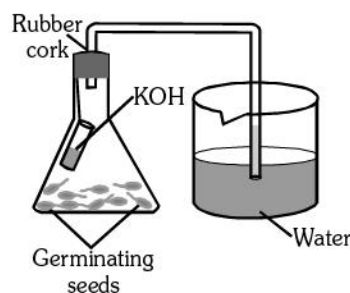


2. In the experiment demonstrating respiration in germinating seeds. KOH is used to
- (1) Absorb carbon dioxide produced by the seeds
  - (2) Absorb oxygen present in the flask
  - (3) Absorb water vapour released by the seeds
  - (4) Liberate oxygen to be used by the seeds
3. The following experiment was set up to show that a gas is given out during respiration. But there was no rise in the level of water. This was because

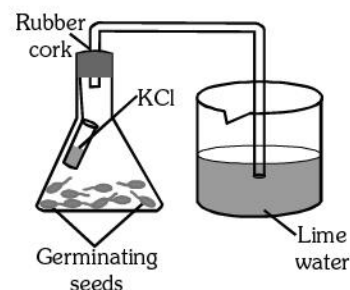


- (1) Germinating seeds have not been kept under water in the flask
- (2) Water is kept in the beaker instead of lime water
- (3) The cork on the flask is made of rubber
- (4) No substance is kept in the flask to absorb gas given out by seeds.

4. In the experiment given here, water will rise in the tube because



- (1) Oxygen of air in the flask will be taken up by the germinating seeds
  - (2) Due to partial vacuum created as carbon dioxide given out by the germinating seeds is absorbed by KOH
  - (3) Carbon dioxide given out will go through the glass tube and push water up into the tube
  - (4) Moisture in the germinating seeds will reach the water in the beaker through the delivery tube.
5. An experimental set up to demonstrate respiration in germinating seeds is shown in the diagram. It is observed that lime water in the beaker turned milky. This is because



- (1) The set up is air tight
- (2) Beaker has coloured water
- (3) Carbon dioxide is not being absorbed
- (4) No oxygen is available to seeds for respiration

### ANSWER KEY

Que.	1	2	3	4	5
Ans.	2	1	4	2	3